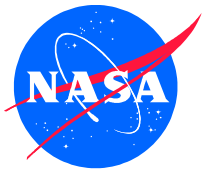

HWCI 3.4.3.1 Flight Computer

- Requirements Traceability
  - DTRD Sections 3.3, 3.4
- Trade Studies
  - Selection of Processor Architecture
    - Rad Hard Full Function Space Rated Processors
    - Bus Architecture (Form Factor)
      - PCI, VME, STD32, PC104
    - Embedded Industrial Grade Flight Computers
  - Selection of PC104 Industrial Grade Supplier
    - Many COTS suppliers available
    - Ampro meets functional and performance requirements

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HWCI 3.4.3.1
Flight Computer

- Functional and Performance Requirements
  - 1.0 PC/AT Functionality
    - a) Processor to be 486 class or above
    - b) COTS, Industrial Grade, Modular in Design
    - c) Meet power performance needs conservatively both in cost and CPU processing power
    - d) Processor to be upgradeable at low cost and with a minimal hardware redesign
    - e) Interface easily with other bus structures such as 1553 Dual redundant data bus , RS232, 422 etc.
    - f) Processor Board to take advantage of new technologies such as Flash Memory, Disk on chip Storage and SSD Storage

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HWCI 3.4.3.1
Flight Computer

- Functional and Performance Requirements (cont.)
  - 2.0 COTS Operating System Software Friendly
    - a) VX Works , Lynx, Qnx, etc.
    - b) Bios to be Programmable
  - 3.0 Environment Operational Requirement
    - a) 100,000 - 130,000ft altitude (mid-latitude)
    - b) -45c to + 85c Temperature Range

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HWCI 3.4.3.1
Flight Computer

- HWCI Description
  - Ampro Core Module /4dxi 133mhz 486DX4 Processor
  - PC/104 Compliant form factor
  - Size : 3.6 x 3.8 x 0.9 in. Weight : 3.4 oz.
  - + 5v +-5% 5 watt max
  - Full function PC/AT with up to 52meg onboard Dram
  - Ruggedized BIOS, Bootable solid State Disk on Chip
  - Onboard Flash to 1meg byte
  - Batteryless boot, watchdog timer, Embedded BIOS
  - Advanced Power Management, +5v operation
  - Extended Operating Temp Range -40c to +85c

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HWCI 3.4.3.1
Flight Computer

- Risk Assessment & Mitigation/Reliability
  - This core module has flown on F-16, 737, 757 research aircraft and on sounding rockets as well
  - Fourteen Year History , Highly Reliable, Proven embedded industrial grade PC/AT System
  - COTS Product

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HWCI 3.4.3.2
PC104 Power Supply

- Requirements Traceability
  - DTRD Sections 3.3, 3.4
- Trade Studies
  - Build in-house
  - Select from multiple COTS vendors
- Key Functional and Performance Requirements
  - PC/104 form factor
  - COTS available and operate in embedded industrial applications
  - Extended Temperature operation -40c to +85c
  - Efficiency up to 95%
  - Output power of 10 amps at 5 volts

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HWCI 3.4.3.2
PC104 Power Supply

- HWCI Description
  - Diamond PC/104 Power Supply
    - HE104-512 WITH OPT-512 & TAC HIGH POWER
      - Clean & filtered Power for PC/104 bus
      - “Load Dump” Transient protection
      - High power converter , high efficiency to 95%
      - + 5v, +/- 12v, 50 watts
      - Operating temp. to -60c to +85c under ideal conditions
      - Fully PC/104 compliant
      - AC Termination instead of DC termination
- Risk Assessment & Mitigation/Reliability
  - COTS Product
  - Flown on NASA Delta Clipper and survived the Crash
  - Redundant items flown

HWCI 3.4.3.3
PC/104 Enclosure

- Requirements Traceability
  - DTRD Section 3.4
- Trade Studies
  - Build in-house
  - Select from multiple COTS suppliers
- Functional and Performance Requirements
  - Shall have easy access to cards
  - Shall be suitable for heat sinking
  - Shall support rail mounting of cards
  - Shall provide EMI isolation
  - Maintain functionality in ULDB environment for mission duration

HWCI 3.4.3.3
PC/104 Enclosure

- HWCI Description
  - Parvus Corp. Chassis Cage System
    - 6” x 7” x10” Long Extrusion, EMI gaskets
    - 8” Aluminum Rails System to hold up to 11 cards
- Risk Assessment & Mitigation/Reliability
  - COTS Product
  - Redundant items flown

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HWCI 3.4.3.4
1553 Interface Card

- Requirements Tractability
  - DTRD Sections 3.4.1.1, 3.4.4.1, 3.5.1.1
- Trade Studies
  - Build in-house
  - Select from multiple COTS suppliers
- Functional and Performance Requirements
  - Shall interface with science Computer for data transfer
  - Shall interface with TDRSS Transmitter / Receiver
  - Meet MIL-SPEC Standard & industrial Grade Environmental Specifications

HWCI 3.4.3.4
1553 Interface Card

- Functional and Performance Requirements (cont.)
  - Dual redundant bus for Failure backup of the Flight computers and data bus
  - PC/104 Form Factor
  - Emulation Capabilities
  - Configurable to Bus controller, Bus Monitor, and remote Terminal Functionality via remote software download
  - Software (RTOS ready, Drivers written and Proven)
  - Input power shall be 4 watts maximum
  - Maintain functionality in ULDB environment for mission duration

HWCI 3.4.3.4
1553 Interface Card

- HWCI Description
  - SBS Avionics Technologies
    - ABI-PC-104xt 1553 interface Card
    - MIL-STD 1553 Full function programmable in three operational modes (BC,BM,RT) Remotely
    - Xlink Gate array for protocol processing
    - Map and Sequential Monitor modes@ 1 Sec time sampling, double buffers for Rt. data logging etc.
    - Digital signal processor routing 1553 words, and packing/decoding messages to program firmware.
    - (RTOS Friendly), VxWorks ready, Full Library of Software Drivers already written and in use
    - Onsite Technical support available

HWCI 3.4.3.4
1553 Interface Card

- Risk Assessment & Mitigation/Reliability
  - These Cards have a long proven history in Military Avionics Projects such as F-22,F16, B2 and in NASA International Space Station Freedom and in flight ground station at GSFC
  - COTS Product
  - Redundant items flown

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HWCI 3.4.3.5
RS-232 Interface Card

- Requirements Traceability
  - DTRD Section 3.4
- Trade Studies
  - Build in-house
  - Select from multiple COTS suppliers
- Functional and Performance Requirements
  - PC/104 Form factor
  - Multiple Serial Ports per Card (need 10 to 12 total)
  - Input power shall be 0.4 watts maximum
  - RTOS Friendly Software drivers written and proven
  - Shall support interrupt sharing

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HWCI 3.4.3.5
RS-232 Interface Card

- HWCI Description
  - Diamond Systems Corp.
    - Emerald-MM v3 Quad 232/422 interface Card (stackable)
      - 4 ports per board, PC/104 form-factor
      - Dual 20 pin headers (2 ports per)
      - Flexible Address and interrupt selection
      - Interrupt sharing
      - +5volt operation, low power
      - 16c554 quad serial port IC that supports data rates to 115kbps and contains 16-byte programmable FIFO buffer to minimize processor overhead
      - Short circuit protection (Indefinite, all outputs)
      - Four layer circuit board (split power and grounds) for noise reduction

HWCI 3.4.3.5
RS-232 Interface Card

- Risk Assessment & Mitigation/Reliability
  - Has Flown on the Space Shuttle used in three separate experiments
  - One Experiment was so successful and reliable that it is scheduled to be one of the first payloads on the Space station
  - COTS Product
  - Redundant items flown

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HWCI 3.4.3.6
SCSI Interface Card

- Requirements Traceability
  - DTRD Sections 3.4.2
- Trade Studies
  - Build in-house
  - Select from multiple COTS suppliers
- Functional and Performance Requirements
  - PC/104 form factor
  - Shall interface to on-board hard disk drives
  - Shall provide two serial ports
  - Input power shall be 0.7 watts maximum

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HWCI 3.4.3.6
SCSI Interface Card

- HWCI Description
  - Ampro MM2/SES
    - Dual serial controller: 16550 compatible, FIFO buffered, one RS232C and one RS232C/485 channel
    - SCSI-II interface: Up to 10 MBytes/sec data - based on popular Adaptec AIC6370 controller
    - 130 mA at 5V
    - -40 to +85 degrees C operating temperature
- Risk Assessment & Mitigation/Reliability
  - COTS Product
  - Redundant items flown